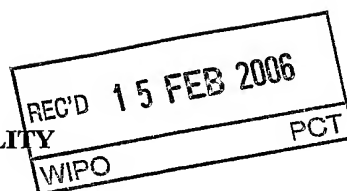


# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)



Applicant's or agent's file reference 7230-20WO	<b>FOR FURTHER ACTION</b>	See Form PCT/IPEA/416
International application No. PCT/US04/36212	International filing date (day/month/year) 29 October 2004 (29.10.2004)	Priority date (day/month/year) 29 October 2003 (29.10.2003)
International Patent Classification (IPC) or national classification and IPC IPC(7): C02F 1/30 and US Cl.: 210/695		
Applicant UNIVERSITY OF MIAMI		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

a. ☒ (sent to the applicant and to the International Bureau) a total of 3 sheets, as follows:

☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) \_\_\_\_\_, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒ Box No. I Basis of the report

☐ Box No. II Priority

☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

☐ Box No. IV Lack of unity of invention

☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

☐ Box No. VI Certain documents cited

☐ Box No. VII Certain defects in the international application

☐ Box No. VIII Certain observations on the international application

Date of submission of the demand 23 August 2005 (23.08.2005)	Date of completion of this report 27 January 2006 (27.01.2006)
Name and mailing address of the IPEA/ US Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Authorized officer  Peter A. Hruskoci DEBORAH A. THOMAS PARALEGAL SPECIALIST Telephone No. 571-272-0987

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/US04/36212

## Box No. I Basis of the report

## 1. With regard to the language, this report is based on:

- ☒ the international application in the language in which it was filed.
- ☐ a translation of the international application into English, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
- ☐ publication of the international application (under Rule 12.4(a))
- ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

- ☐ the international application as originally filed/furnished
- ☒ the description:  
pages 1-28 as originally filed/furnished  
pages\* NONE received by this Authority on \_\_\_\_\_  
pages\* NONE received by this Authority on \_\_\_\_\_
- ☒ the claims:  
pages NONE as originally filed/furnished  
pages\* NONE as amended (together with any statement) under Article 19  
pages\* NONE received by this Authority on \_\_\_\_\_  
pages\* 29-31 received by this Authority on 23 August 2005 (23.08.2005)
- ☒ the drawings:  
pages 1-16 as originally filed/furnished  
pages\* NONE received by this Authority on \_\_\_\_\_  
pages\* NONE received by this Authority on \_\_\_\_\_
- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Claims <u>1-13, 15, 16, and 19</u>	YES
	Claims <u>14, 17, and 18</u>	NO
Inventive Step (IS)	Claims <u>NONE</u>	YES
	Claims <u>1-19</u>	NO
Industrial Applicability (IA)	Claims <u>1-19</u>	YES
	Claims <u>NONE</u>	NO

**2. Citations and Explanations (Rule 70.7)**

## Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

## V. 2. Citations and Explanations:

Claims 14, 17, and 18 lack novelty under PCT Article 33(2) as being anticipated by Matsumoto et al. 3,461,067. It is submitted that Matsumoto et al. disclose (see col. 1 line 60 through col. 3 line 58) the system structure as recited in the instant claims.

Claim 15 lacks an inventive step under PCT Article 33(3) as being obvious over Matsumoto et al. as above, in view of Miller et al. 6,177,016. The claim differs from Matsumoto et al. as applied above by reciting that the reaction chamber is a fluidized bed. Miller et al. disclose (see col. 3 line 9 through col. 5 line 67) that it is known the art to utilize a fluidized bed of iron particles, to aid in removing contaminants from water. It would have been obvious to one skilled in the art to modify the system of Matsumoto et al. by utilizing the recited fluidized bed in view of the teachings of Miller et al., to aid in reducing the concentration of contaminants in the water.

Claims 16 and 19 lack an inventive step under PCT Article 33(3) as being obvious over Matsumoto et al. as above, in view of Gurol et al. 6,531,065. The claims differ from the references as applied above by reciting that the system comprises a magnetic field source or an ultraviolet source. Gurol et al. disclose (see col. 4 line 23 through col. 7 line 50) that it is known the art to utilize ultraviolet light and an iron source, to aid in removing perchlorate from water. Gurol et al. further teach the use of a magnetic field to assist the removal of iron metal from the water. It would have been obvious to one skilled in the art to modify the system of Matsumoto et al. by utilizing the recited ultraviolet and magnetic field sources in view of the teachings of Gurol et al., to aid in reducing the concentration of contaminants and iron metal in the water.

Claims 1-4 and 8-12 lack an inventive step under PCT Article 33(3) as being obvious over Matsumoto et al. in view of Pommier 5,599,372. The claims differ from Matsumoto et al. as applied above by reciting that the influent water includes chelated metal formed by contacting soil or sediment with a chelating agent such as EDTA. Pommier disclose (see col. 4 line 26 through col. 8 line 63) that it is known the art to utilize EDTA to remove metals from soil, and to recover metals from an aqueous phase containing EDTA by precipitation and flocculation. It would have been obvious to one skilled in the art to utilize the method Matsumoto et al. to treat the recited influent water in view of the teachings of Pommier, to aid in reducing the concentration of contaminants in the water.

Claim 5 lacks an inventive step under PCT Article 33(3) as being obvious over Matsumoto et al. and Pommier as above, and further in view of Gurol et al. 6,531,065. The claim differs from the references as applied above by reciting that the contacting step includes ultraviolet radiation. Gurol et al. disclose (see col. 4 line 23 through col. 7 line 50) that it is known the art to utilize ultraviolet light and

**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**International application No.  
PCT/US04/36212**Supplemental Box**

an iron source, to aid in removing perchlorate from water. It would have been obvious to one skilled in the art to modify the references as applied above, by utilizing the recited ultraviolet radiation in view of the teachings of Gurol et al., to aid in reducing the concentration of contaminants and iron metal in the water.

Claim 6 lacks an inventive step under PCT Article 33(3) as being obvious over Matsumoto et al. and Pommier as above, in view of Miller et al. 6,177,016. The claim differs from the references as applied above by reciting that the method is performed in a fluidized bed. Miller et al. disclose (see col. 3 line 9 through col. 5 line 67) that it is known the art to utilize a fluidized bed of iron particles, to aid in removing contaminants from water. It would have been obvious to one skilled in the art to modify the references as applied above by utilizing the recited fluidized bed in view of the teachings of Miller et al., to aid in reducing the concentration of contaminants in the water.

Claim 7 lacks an inventive step under PCT Article 33(3) as being obvious over Matsumoto et al. in view of Pommier and Miller et al. as above, and further in view of Oeste 5,480,524. The claim differs from the references as applied above by reciting that the method comprises magnetically-controlled fluidizing. Oeste disclose (see col. 2 line 58 through col. 4 line 50) that it is known the art to utilize a magnetic flux to aid in rearranging particles in a fluidized bed for degrading contaminants. It would have been obvious to one skilled in the art to modify the references as applied above by utilizing the recited magnetically-controlled fluidizing in view of the teachings of Oeste, to aid in rearranging particles in the fluidized bed.

Claim 13 lacks an inventive step under PCT Article 33(3) as being obvious over Matsumoto et al. and Pommier as above, in view of Sivavec 5,750,036. The claim differs from the references as applied above by reciting that the contacting step includes iron-reducing bacteria for reducing Fe<sup>+3</sup> to Fe<sup>+2</sup>. Sivavec disclose (see col. 2 lines 55-67) that it is known the art to introduce ferrous ion into contaminated soils or sediments by dissolution of ferrous ions produced by the growth of iron-reducing bacteria. It would have been obvious to one skilled in the art to utilize the references as applied above by including the recited bacteria in the contacting step in view of the teachings of Sivavec, to aid in introducing ferrous ions into the water.

Claims 1-13, 15, 16, and 19 meet the criteria set out in PCT Article 33(2), because the prior art does not disclose the method steps and structure of the system recited in the instant claims, respectively.

Claims 1-19 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry to remove contaminants from water.

## CLAIMS

We claim:

1. A water or wastewater treatment method, comprising the steps of:  
providing an Fe source, said Fe source comprising an Fe salt or Fe metal, and  
contacting influent water including at least one chelating agent in the form of a chelated metal with said Fe source in the presence of an oxygen comprising gas flow, wherein an outlet flow following said contacting step provides oxidation of said chelating agent and other oxidizables in said influent water and precipitation, co-precipitation, or reaction of products of said oxidation to form a metal sludge.
2. The method of claim 1, wherein said Fe salt comprises a ferrous salt.
3. The method of claim 1, wherein said Fe salt comprises ferrous sulfate or ferrous carbonate.
4. The method of claim 1, wherein said method is performed in a pH range of from 5 to 9.
5. The method of claim 1, wherein said Fe source is said Fe metal, said contacting step including ultraviolet irradiation.
6. The method of claim 1, wherein said method is performed in a fluidized bed reactor.

7. The method of claim 6, wherein said fluidized bed reactor includes at least one magnetic field source, further comprising the step of magnetically-controlled fluidizing.
8. The method of claim 1, further comprising the step of separating said outlet flow into treated effluent and said metal sludge, wherein said separating step comprises sedimentation or filtration of said metal sludge.
9. The method of claim 1, further comprising the step of contacting soil or sediment having metal with a chelating agent to form said chelated metal.
10. The method of claim 9, wherein said chelating agent comprises ethylenediaminetetraacetate (EDTA) or an EDTA derivative.
11. The method of claim 1, wherein said contacting step is performed at ambient conditions and exclusive of any externally applied energy sources.
12. The method of claim 1, wherein said Fe metal comprises Fe filings, steel wool or Fe comprising granules.
13. The method of claim 1, wherein said Fe salt is a ferric salt, said contacting step converting  $\text{Fe}^{+3}$  to  $\text{Fe}^{+2}$  using at least one selected from the group consisting of exposure to iron-reducing bacteria, exposure to UV radiation, exposure to hydrogen peroxide, and exposure to electrodes in an electrolytic solution.

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14. A water treatment system, comprising:

a reaction chamber including an Fe source, said Fe source comprising an Fe salt or Fe metal, and

a source of an oxygen comprising gas, said oxygen comprising gas fluidically connected to said reaction chamber,

wherein when influent water including at least one chelating agent in the form of a chelated metal is contacted with said Fe source in the presence of said oxygen comprising gas, a flow emerging from said outlet providing a oxidation of said chelating agent and other oxidizables and precipitation, co-precipitation, or reaction of products of said oxidation to form a metal sludge.

15. The system of claim 14, wherein said reaction chamber is a fluidized bed.

16. The system of claim 14, wherein said system includes a magnetic field source.

17. The system of claim 14, wherein said Fe salt comprises a ferrous salt.

18. The system of claim 17, wherein said Fe salt comprises ferrous sulfate or ferrous carbonate.

19. The system of claim 14, further comprising an ultraviolet or ultrasonic source.